NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

ISSUES IN MANAGING THE
MICROCOMPUTER INFORMATION RESOURCES
IN THE NAVAL AVIATION COMMUNITY

by

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The proliferation of microcomputer systems within Naval Aviation organizations in this decade has forced managers to rethink the role of information production. This thesis addresses the inter- action of the organization process on information production, which Navy managers must be aware of in order to perform their job. The role of information management is examined to allow management to use existing microcomputer information systems capabilities more effectively. Discussion includes the impact of (Continued)

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ABSTRACT (Continued)

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Issues in Managing the
Microcomputer Information Resources
In the Naval Aviation Community

by

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from the

ABSTRACT

The proliferation of microcomputer systems within Naval Aviation organizations in this decade has forced managers to rethink the role of information production. This thesis addresses the interaction of the organization process on information production, which Navy managers must be aware of in order to perform their job. The role of information management is examined to allow management to use existing microcomputer information systems capabilities more effectively. Discussion includes the impact of microcomputer systems on the flow of information, and microcomputer assistance to management in planning, problem solving, and decision making. Research findings indicate that management of microcomputers has increased the actual time and cost of information flow within organization units. Security of classified materials processed on microcomputers and training of user skills are deficient. Organizations need to incorporate a specialized computer manager.

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I. INTRODUCTION

During the past century explosive growth in industry has come in the form of new technologies. Entire societies have been changed and reorganized several times in the span of a single life time. Rapid change in our society seems to have followed similar paths for the computer and the internal combustion engine.

At the turn of this century, a business man could take his family on a Saturday afternoon picnic to the local park, and watch horse-and-buggies pull by. He might spend an entire day and see only one car, which was probably large and individually handcrafted. Cars then were beautiful and very expensive, costing in the order of 2,500 dollars (or approximately 43,000 dollars in the 1985 economy). Because of the high cost, few people could afford to own one.

At times the automobile proved to be impractical. If the car owner were on a long journey across the country, and his car broke down, there would not be a place to purchase new parts. He would have to cable the factory, and a machinist would have to travel to the site. The machinist would have to handcraft and fit a new part to the car. Then Henry Ford developed an automobile that capitalized on the

concepts of standardized production procedures and mass production. By 1913 he was able to maximize the effects of assembly lines and interchangeable parts to produce over 1000 Model T's a day. In the span of ten years, the price of a car dropped to about 500 dollars. (This represents a price drop from 43,000 to 6,500 dollars in the 1985 consumer market.) Almost everyone could buy one. A customer could purchase a Model T in any color he wanted, as long as it was black. The great power of the automobile was unleashed and our society would never again be the same.

The microcomputer, the computer-age Model T, has changed the way people must look on how they do business. In the 1960's, the early computers were large mainframes. Only big business and government could afford to own and operate them. The industry breakthrough came when the mainframe's central processing unit was reduced to a small semiconductor integrated circuit, and placed on a thin silicon chip. By 1977, computer hobbyists were able to purchase kits and assemble crude microcomputers. Mass production and marketing of general purpose microcomputers began in 1979 with the Apple Corporation and others, followed by IBM in 1981. Though the technological development of the computer and the automobile followed similar paths, the microcomputer development life cycle is much shorter. The automobile took 70 years for 70% of the general population to have access to

one. The microcomputer, on the other hand, has accomplished it in less than 10 years. With the proliferation of microcomputers, some companies have more microcomputers than employees. [Ref. 1]

Only ten years ago, a Naval aviation squadron felt fortunate to have an electric typewriter to process their administrative workload. The aviation unit was geared to maximize its operational output while little thought had been given to information systems management. Following the Vietnam era, a peace time environment has forced more and more of management's attention to the administration of information and personnel. Traditionally a squadron's working climate was influenced by the philosophy of the Commanding Officer; whose values, objectives, and management style were mimicked by the officer corps, and from this leadership base the flow of ideas and communication were determined.

Microcomputer office communications began to make their appearance in Naval Aviation units in 1981. The usual hardware procurement lag associated with the Department of Defense actually helped in obtaining a better computer product. Microcomputer technology was advancing rapidly and prices were falling even faster. By the time funds could be obtained in the budget process, the microcomputer arena was a buyer's market-place. Ready availability and

low prices made it possible for the Department of Defense and the Navy to make massive purchases of hardware microcomputer products for use by operational units.

In 1984, the Department of Defense purchased 17,419 microcomputer information systems. From this purchase, the Department of the Navy received 10,649 systems. This was a 450% increase over 1983. The massive influx of microcomputers into the Naval organization changed the management of information, and left managers without a past to draw upon in managing the microcomputer. The phrase, "But that's how we have always done it" will have to wait another generation to re-emerge in this arena. [Ref. 2]

Commanding Officers, as well as their senior management staff, were out of the civilian management mainstream long enough to miss the impact of microcomputer resources. They lacked the education, training, and experience their civilian counterparts acquired.

Today the Naval officer is faced with the problem of managing the powerful capacity of microcomputers and must quickly learn how to effectively implement and use this new resource.

II. THE RESEARCH STUDY

A. THE RESEARCH QUESTION

The purpose of this research is to assess the Navy managers' capability to effectively use their microcomputer information systems. The research question of this thesis is as follows: what are the present and future roles of microcomputer information systems within the Navy's Aviation management structure. To address this question the research was divided into two parts. (see Table I)

Part I: The aim of the first part of the research is to assess the impact of microcomputers on the flow of information, communication, and ideas between management levels. Part I was divided into four sections.

1. Identify microcomputer driven data flow between management levels.
2. Examine how Commanding Officers use microcomputers in managing their functional departments.
3. Identify individual microcomputer information system users by management level.
4. Identify microcomputer processed information, and examine information production workloads.

Part II: The second part of the research addresses three key issues in managing the microcomputer resource.

TABLE I

RESEARCH DESIGN

The Research Question
--- -------- --------

Part I The Impact of Microcomputer Systems on the Flow of
        Information

    1. Data flow identification
    2. Microcomputer use by Commanding Officers
    3. Microcomputer use by management level
    4. Microcomputer processed information

Part II Managing Microcomputer Resources
        (divided into three issues)

    First Issue-Microcomputer potential

        1. Current microcomputer systems
        2. Development of microcomputer systems
        3. Management's perceptions

    Second Issue-Procedures, standards, and guidelines

        1. Current policies and procedures
        2. Procedure development
        3. Conflicts between management levels
        4. Conflicts across management levels
        5. Conflict resolution

    Third Issue-Microcomputer training requirements

        1. Current computer literacy
        2. Computer literacy comparisons
        3. Past training patterns
        4. Training perceptions
        5. Future training needs

The first management issue is the potential and use of microcomputer systems in planning, problem solving, and decision making. This issue was sub-divided into three sections.

1. Identify current microcomputer information systems and determine if they are being used for planning, problem solving, and decision making.

2. Search for any ongoing development of microcomputer information system processes and their intended use.

3. Obtain management's assessment of microcomputers and their ability to meet management's information needs.

The second management issue is the development of operating procedures, standards, and guidelines for microcomputer systems. This issue was sub-divided into five sections.

1. What are management's current policies, procedures, and standards for microcomputer information systems?

2. Whom do they (policies, procedures and standards) affect, who is accountable and responsible for developing, measuring, and enforcing them?

3. Do microcomputers cause different types of conflicts at different management levels?

4. Are microcomputer conflicts similar in different units at the same management level?

5. How does management resolve microcomputer conflicts?

The third management issue is to determine the level of present microcomputer skills, tools, and training levels of management, and the direction of future management needs for microcomputer information production. This last management issue was sub-divided into five sections.

1. What is the current level of computer literacy of the three management levels?

2. Is microcomputer knowledge the same at different levels of management?

3. How has current microcomputer knowledge and experience been obtained?

4. Do managers perceive their computer based knowledge and training adequate?

5. What training and education do managers feel is needed to improve future management skills for the microcomputer work environment?

B. METHODOLOGY

The major portion of research material was gathered through 53 one hour interviews of management personnel in five aviation squadrons, one carrier airwing, and one Pacific airwing. The interview schedule contained from 25 to 31 research questions depending on the management level being interviewed. (Appendix A) Before being used in the field, two prototype interviews were conducted on two students. Actual field interviews were conducted over a

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five month period from March 1985 to July 1985. The distribution of interviews by officer rank are displayed in Table II.

TABLE II

INTERVIEW DISTRIBUTION BY OFFICER GRADE

Rank	Rate	Number Interviewed
Rear Admiral	08	1
Captain	06	2
Commander	05	11
Lt. Commander	04	12
Lieutenant	03	15
Lieutenant J.G.	02	6
Ensign	01	4
CPO	E7-9	2

Total Interviews - 53

The interview questions for the first part of the research question are displayed in Table III. Interview questions addressing the first, second, and third management issues of the second part of the research question are displayed in tables IV, V, and VI respectively.

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TABLE III

PART I-RESEARCH INTERVIEW QUESTIONS

	Top Management	Middle Management	Operational Management
	----------	----------	----------
	CO/XO	Department Head	Division Officer
Research Section		Research Interview Questions	
1.	1,2,3,4,5, 10,19	1,2,3,4,7,24	1,2,3,4,5,6,11, 28
2.	1,2,10,13	1,2,7,10	1,2,3,4,5,6,11, 14,
3.	11,12,20, 22	9,10,15,16	8,19,20
4.	6,9,22	5,16	7,10,20

Interview question numbers refer to questions in the interview question schedule presented in Appendix A.

A microcomputer assessment questionnaire was prepared and given to each officer interviewed. (Appendix B) Additionally, 47 questionnaires were distributed to 6 other units. Twenty-three were returned yielding a total of 81 completed questionnaires. The questionnaire was designed to determine Navy manager's assessment of microcomputer information system performance in meeting information production needs. Microcomputers were rated for accuracy, consistency, timeliness, and volume processing capabilities.

TABLE IV

PART II-FIRST MANAGEMENT ISSUE INTERVIEW QUESTIONS

	Top Management	Middle Management	Operational Management
	CO/XO	Department Head	Division Officer
Research Section	Research Interview Questions		
1.	6,8,9,21,23	5,6,15,25	7,9,10,19,29,31
2.	23	24,25	11,20,29
3.	18,22,23	16,22	19,20,26

Interview question numbers refer to questions in the interview question schedule presented in Appendix A.

The survey results were averaged and compared by management level.

At the end of each interview, a descriptive and schematic model of past and present information flow within an aviation unit was presented to the manager. The manager was asked to evaluate the information flowchart and make any corrections or additions to the model. The manager's comments were then incorporated into the models and the process was repeated at the next interview.

TABLE V

PART II-SECOND MANAGEMENT ISSUE INTERVIEW QUESTIONS

	Top Management	Middle Management	Operational Management
	----------	----------	----------
	CO/XO	Department Head	Division Officer
Research Section	Research Interview Questions		
1.	16,17	13,14,17,18	17,18,21,22
2.	16,17	14,17,18	18,21,22
3.	11,20,24, 25	8,14,17,18, 19,20,21,23	12,18,21,22,23, 24,25
4.	11,20,22	8,16,17,18, 23	12,21,22,27
5.	21,22	17,18	21,22,27

Interview question numbers refer to questions in the interview question schedule presented in Appendix A.

C. OBJECTIVE AND SCOPE

The intent of this research is to examine Naval Aviation Unit information flow in microcomputer information systems, and ultimately, to provide the   manager with a perspective on the role of information production in the organizational unit.

The reader is presented with an overview of information user groups and their relationships.   Past and present

TABLE VI

PART II-THIRD MANAGEMENT ISSUE INTERVIEW QUESTIONS

	Top Management	Middle Management	Operational Management
	CO/XO	Department Head	Division Officer
Research Section	Research Interview Questions		
1.	7	26	8,30
2.	7,11	8	8,12
3.	12,13,18	9,10	13,14
4.	13,14	10,11,25	14,15,31
5.	15	12,25	16,30,31

Interview question numbers refer to questions in the interview question schedule presented in Appendix A.

----

information flow within the organization are described in some detail. The impact and potential of microcomputer information systems on planning, problem solving, and decision making are reviewed. The topic of information system standards and procedures along with management computer literacy and training are examined. A final section addresses the direction future management needs to take in order to effectively use the microcomputer resource.

III. INFORMATION PRODUCTION

A. USER GROUPS

Today's Navy requires the Commanding Officer of a Naval
Aviation unit to be an information manager. He must
determine the value of information, and regulate the
information flow. The Commanding Officer performs all the
duties and functions of a corporate General Manager. He is
the officer-in-charge, accountable for all the activities
and the performance of the squadron. He is responsible
for both the administration and direction of the unit. A
major function of the Commanding Officer is to review and
evaluate the impact of information, ideas, and decisions
on the unit as a whole. He must decide what actions are
best from the stand point of the unit.

Information by itself is inert. Once data has been
collected, processed, and information output, it must be
fed into the human brain before meaningful knowledge and
intelligence can be obtained. The Navy manager serves as
the primary component of the feedback and control of the
Information Control Cycle (Figure 3.1).

A typical squadron management structure consists of four
functional departments: safety, operations, administration,
and maintenance (Figure 3.2). The Department Head is

```
+-----------------------------------------------------------------------+
|                     INFORMATION PROCESSING                            |
|                      +-----------------------+                        |
|                      |         PEOPLE         |                        |
|    .-----DATA--->|    |        SOFTWARE        |   ---->INFORMATION    |
|    |             |    |        HARDWARE        |              |        |
|    |             |    +-----------------------+              |        |
|    |                                                         |        |
|    |                  INFORMATION CONTROL                    |        |
|    |                  +-----------------------+              |        |
|    |                  |                        |  <----------'        |
|    | <--FEEDBACK--    |         NAVY            |    (Knowledge)       |
|    |                  |        MANAGER          |  ---->OUTPUT         |
|    |                  |                         |    (Tasking)         |
|    '-----DATA----|    | < - - - - - - - - - - |  <------INPUT         |
|                      +-----------------------+                        |
+-----------------------------------------------------------------------+
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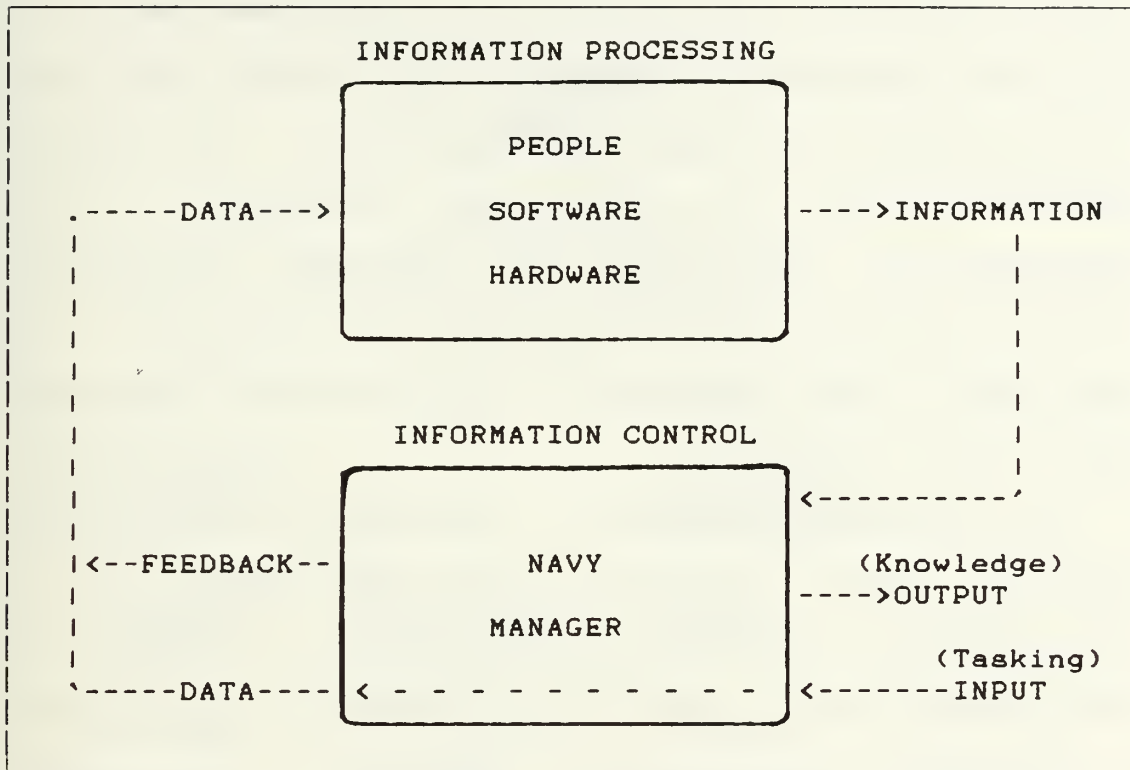
Figure 3.1   Information Control Cycle

responsible for the coordination and implementation of
the functional duties of his department.   Integration   of
these   departments   into   a   functioning   organization   is
conducted via a board meeting comprised of the Department
Heads with the Executive Officer and the Commanding Officer
overseeing department performance.   Though a Department Head
will make decisions over his area of responsibility, he has
access   to   information   on   the   operation   of   all   other
departments.   This   information allows   him to   be able   to
develop   influence in   the other   departments.   A Division

Officer works for and reports to a Department Head. The duty and responsibility boundaries are flexible and change at the direction of the Department Head. The Division Officer manages the day-to-day operations of his responsibility environment. The squadron contains the traditional three levels of the management hierarchy: top management, middle management, and operational management [Ref. 3: pp. 15-24].

The operational managers are represented as the Division Officers, middle management by Department Heads, and top management by the Commanding and Executive Officers. All three levels participate in the Information Control Cycle. In this study three management user groups were surveyed. With the advent of the microcomputer, all three management levels have become participants in the process phase of information flow. Within the management hierarchy the middle manager had the broadest scope in the Information Control Cycle. Table VII shows the distribution of microcomputer users by management level. The middle manager group is the management level with the largest number of personnel who are familiar with the use of microcomputer systems.

With the easy access of microcomputers, four distinct user groups have developed: the executive, the middle manager, the operational manager, and the division worker.

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```
                    ┌─────────────────┐
                    │   COMMANDING    │
                    │    OFFICER      │
                    └─────────────────┘
                             │
                    ┌─────────────────┐
                    │   EXECUTIVE     │
                    │    OFFICER      │
                    └─────────────────┘
                             │
      .──────────────────────┼───────────────────────────.
      │               │             │                    │
┌─────────────┐       │       ┌─────────────┐            │
│ MAINTENANCE │       │       │    ADMIN.   │            │
│   OFFICER   │       │       │   OFFICER   │            │
└─────────────┘       │       └─────────────┘            │
  │                   │         │                        │
  │-AIRCRAFT          │         │-LEGAL       ┌─────────────┐
  │ DIVISION    ┌─────────────┐ │ OFFICER     │   SAFETY    │
  │             │ OPERATIONS  │ │             │   OFFICER   │
  │-LINE        │   OFFICER   │ │-ESO         └─────────────┘
  │ DIVISION    └─────────────┘ │ OFFICER       │
  │               │             │               │-AVIATION
  │-AVIONICS      │-TRAINING    │-PERSONNEL      │ SAFETY
  │ DIVISION      │ OFFICER     │ OFFICER        │ OFFICER
  │               │             │                │
  │-MAINT/MAT.    │-SCHEDULING  │                │
  │ CONTROL       │ OFFICER     │-PUB/AFFAIRS    │-PILOT
  │               │             │ OFFICER        │ NATOPS
  │               `-COMM.       │                │
  `-QUALITY          OFFICER    `-1st.          `-NFO
    ASSURANCE                     LT.             NATOPS
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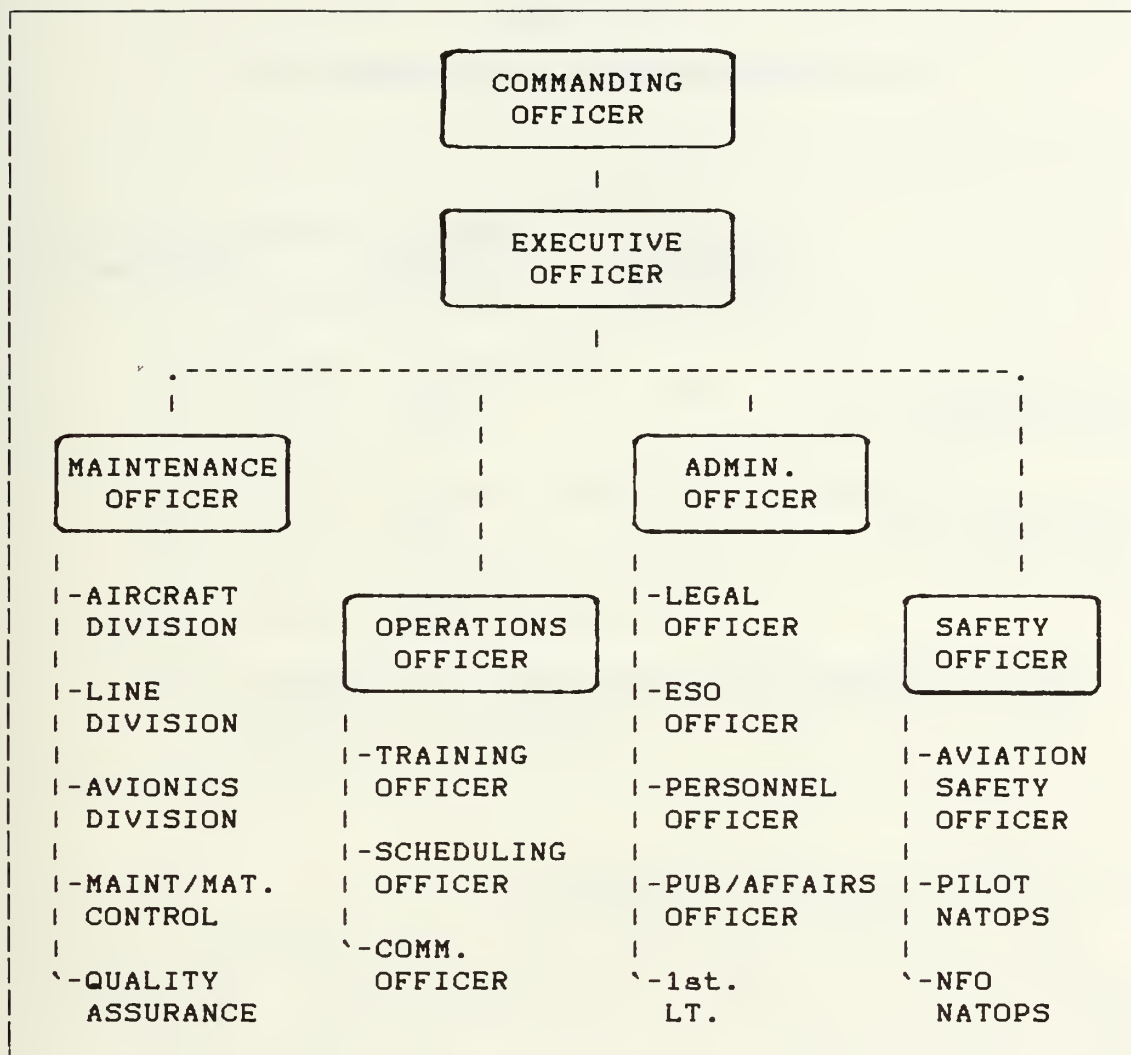
Figure 3.2   Aviation Squadron Functional Management Structure

These four groups are all contending for the same resources,
at the same time, and for different needs. The successful
integration of these forces seems to be the key to an
effective information processing system.

TABLE VII

MICROCOMPUTER SYSTEM USERS

	Top Management	Middle Management	Operational Management
Occasionally use Microcomputer	9%	20%	6%
Frequently use Microcomputer	-	14%	5%
	9%	34%	11%

Numbers indicate the percentage of managers of the three levels who use microcomputer systems.

B. INFORMATION SYSTEM MANAGEMENT

The Xerox 860 word processor was introduced in the squadron units in 1982. This microcomputer was specially built for word processing with a minor capability for data storage, retrieval, and report generation. The 860 quickly became the work-horse of the administrative department, handling 90% of the workload. The 860 was adapted for many uses including internal information needs and external information output (Table VIII).

By 1983 a second machine had been received and units were now faced with ownership and control of two machines. In every unit observed, a course of decentralization was

TABLE VIII

ELECTRONICALLY PROCESSED INFORMATION

----

1. Command personnel award letters.

2. Correspondence to higher authority.

3. Enlisted evaluations.

5. Message traffic.

6. Military orders, temporary and permanent.

7. Monthly and annual reports.

8. Officer fitness reports.

9. Stored blank and formatted documents.

10. Squadron instructions.

----

taken and the maintenance department was given the second machine. The reason for the decision was one of size; the maintenance department was the largest department, consisting of 85% of all squadron personnel. This action broke from the tradition of functional separation of tasking. Prior to this, maintenance was dependent upon the administration department for the majority of their administrative needs. The move shifted the balance of control away from the Administration Officer towards the Maintenance Officer. The administration department, (a service organization tasked with supplying the

administrative needs of the unit) no longer had full control of the administrative resources to accomplish its mission. The maintenance department had the choice of sending the administrative workload to administration or to process information needs internally. Duplication of data, and reports of various versions and revisions, were found on different department disks. Time schedules for document submission and machine availability scheduling, emerged as coordination issues affected by the decentralization of functional responsibilities and microcomputer resources.

In 1984-85, operational units began receiving the Zenith-120 microcomputer. This was the first effective general purpose microcomputer the squadrons had received. Generally, the units opened the Zenith-120 for officer use, with the operations department being given actual custody of the microcomputer. This increased the decentralization of the unit's microcomputer resources and has had an impact in broader exposure, more training, and increased interest in using the microcomputer. Managers who have used the microcomputer to solve their problems have expressed a desire to learn more uses of the machine.

C. INFORMATION FLOW

Before the advent of electronic processing, the flow of information was mechanically difficult but systematically simple. A top-down and bottom-up document flow (Figure 3.3)
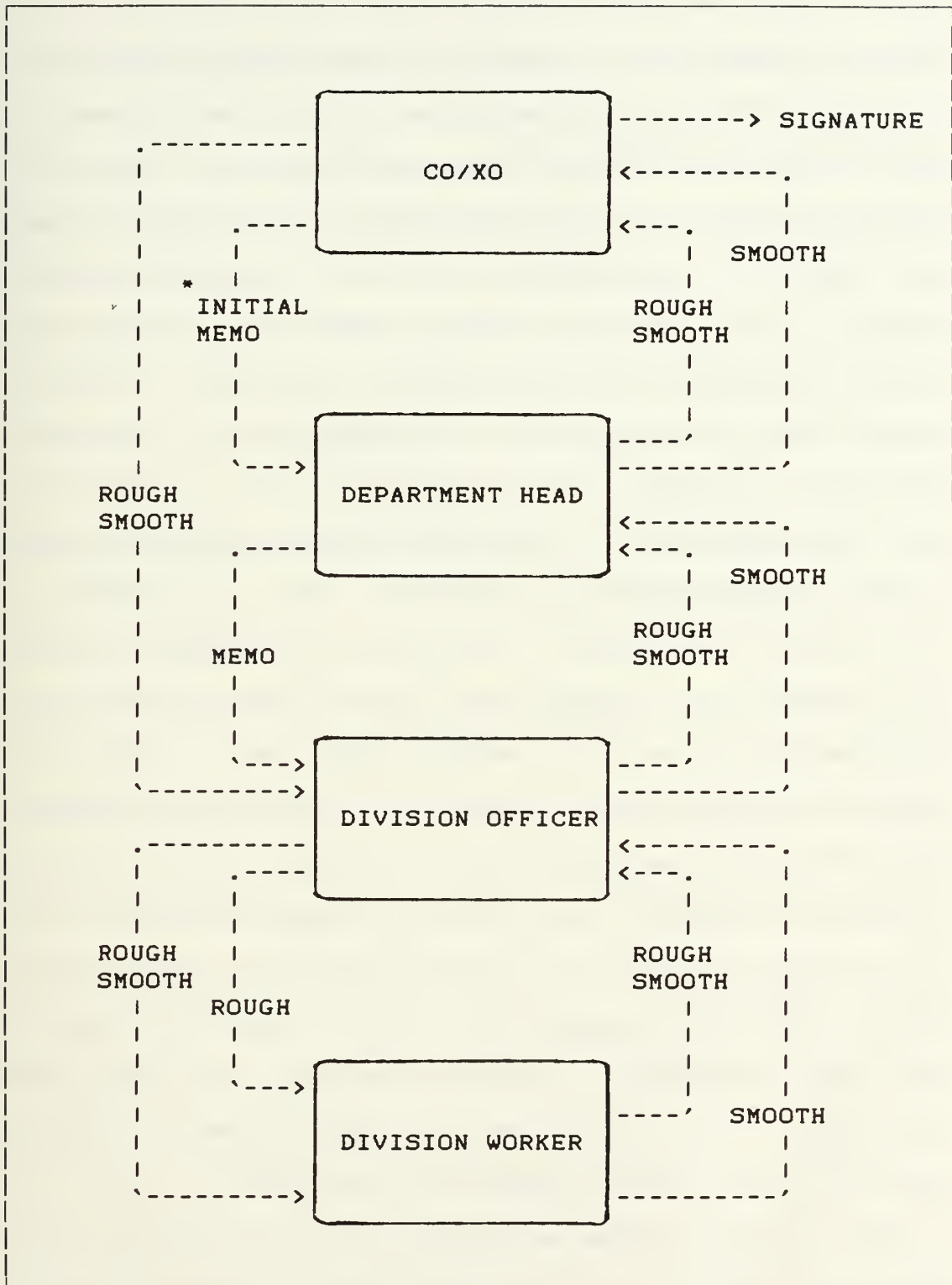
```
                    +---------------------+
                    |                     |  --------> SIGNATURE
                    |       CO/XO         |  <-----------.
                    |                     |              |
                    |                     |  <---.       |
                    +---------------------+      |    SMOOTH
        *                                        |       |
    .   INITIAL                              ROUGH       |
        MEMO                                 SMOOTH      |
                                                 |       |
                                                 |       |
                    +---------------------+  ----'       |
            '--->   |                     |  ------------'
   ROUGH            |   DEPARTMENT HEAD   |
   SMOOTH           |                     |  <---------.
      |             |                     |  <---.     |
      |             +---------------------+      |   SMOOTH
      |                                          |     |
      |  MEMO                               ROUGH      |
      |                                     SMOOTH     |
      |                                         |      |
      '--->                                     |      |
    '-------->      +---------------------+  ---'      |
                    |                     |  ----------'
                    |  DIVISION OFFICER   |
                    |                     |  <---------.
        .---------  |                     |  <---.     |
        .----       +---------------------+      |     |
   ROUGH                                    ROUGH      |
   SMOOTH                                   SMOOTH     |
      |   ROUGH                                 |      |
      |                                         |      |
      '--->          +---------------------+    |      |
                     |                     |  --'   SMOOTH
      '--------->    |   DIVISION WORKER   |          |
                     |                     |  --------'
                     +---------------------+
```

Figure 3.3   Manual Processing Document Flow

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started with a hand written memo from the Commanding Officer. This memo, normally a request for action and a completed information document, would flow down through the Executive Officer to the respective Department Head. The Department Head would add amplifying instructions to the memo and give the request to the designated Division Officer. The Division Officer would then collect and process the needed data to complete the task. He would submit a hand written rough to the administration department for manual processing where a division worker would type a rough-smooth document. The rough-smooth would be returned to the originating Division Officer. The Division Officer would review the document, annotating corrections, then pass the document up to the Department Head. The Department Head would review the document, making additions or deletions, then he would send the document up to the Executive Officer. This process was repeated by the Executive Officer and the Commanding Officer, with the reviewed document being returned to the originating Division Officer. The Division Officer would then ensure that a final smooth document was prepared for signature, checking for all corrections of his superiors. Once he verified the final document, he would send it up the chain of command for signature.

The conversion from a manual to a microcomputer driven information system has changed the lines of communication as

well as the flow of information (Figure 3.4). The extent of
the change depends upon whether the top or middle managers
are actually using the microcomputer systems themselves.
Information requests from the Commanding Officer will
generate in a similar fashion as before, following the same
waterfall down to the Division Officer. Changes are
beginning to occur at the department head level.
Department Heads who have gained a working level of
experience on the machines have reported generating a
computerized memo attaching to or replacing the memo.
Sometimes the Commanding Officer's request is verbal and
this would be the first time the requirement had been
recorded on paper.

Division Officers who have gained experience on the
microcomputer have shown a tendency to prepare short reports
and documents without using the administration division
worker. Division Officers using the administration workers,
will review, correct, and send back all documents until all
their corrections are incorporated into the rough-smooth.
This may take two or three iterations before the Department
Head sees the document. At the Department Head and
Executive Officer levels, the process of corrections,
additions, and deletions are repeated with the rough-smooth
being sent back to the division worker for corrections
before the manager sends the document on to the next higher
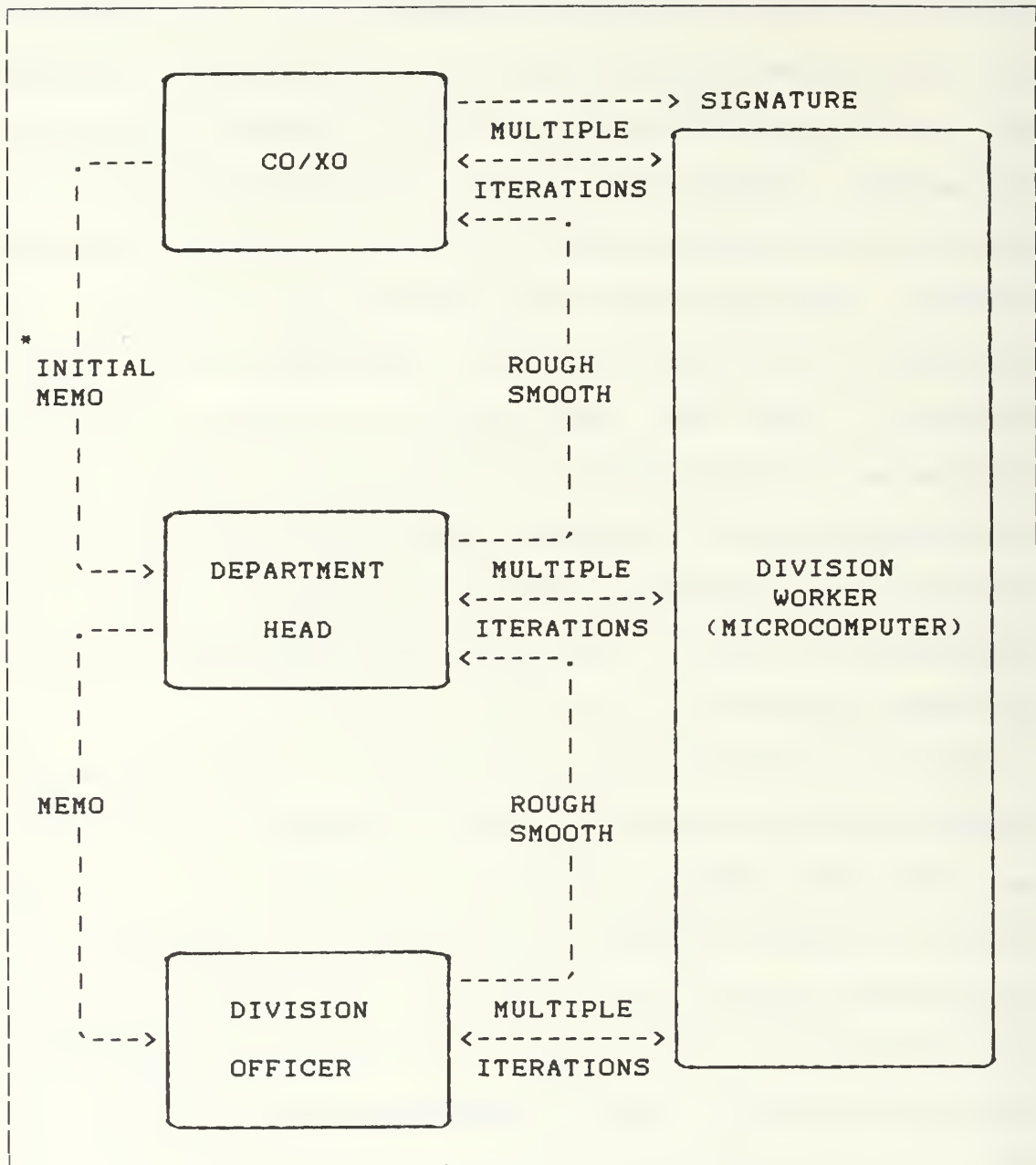
Figure 3.4   Computerized Processing Document Flow

level.   Each time the document is sent back for revision,

lower managers are not normally included in the review

process. The individual manager deciding on the document changes, and the worker making the corrections are communicating directly. Once the document reaches the Commanding Officer, he will send the document back to the division worker until he feels it is ready for signature. This process has eliminated the previous smooth run, but has caused a dramatic increase in workload for the division worker. One division worker commented, "seeing a letter more than 10 times before the skipper signs it, is not unusual". It appears the shorter the deadline, the less a document will be returned for update. At the same time, the shorter the deadline, the more likely a manager is to use a microcomputer if he knows how. On the average, division workers reported seeing the same document, for an update, from 4 to 6 times before the final product was completed. This may not seem to be too dramatic until one applies the average multiplier of 5 on every piece of paper that is processed.

D. INFORMATION PROCESSING

Two major issues need to be addressed in information processing: the cost of time and the cost of supplies. Two documents flowing in the computerized processing system may never take the same processing paths. The number of iterations, or processing paths, have increased the actual time a document is in the system. In the manual processing

environment, a letter may spend 3 to 5 days being processed. That same letter now may take as long as 1 to 2 weeks. Microcomputer technology has made the process of producing a document easier. The ease of document production has made it attractive to make numerous revisions at different management levels. A closely related problem is the tracking down of a document once it is in the system. Because a piece of work may take many paths, it has become difficult at times of high volume processing to track down and locate the document. One Commanding Officer said, "I am getting different versions of the same piece of correspondence or monthly reports, showing up on my desk at the same time." With the decentralization of microcomputer resources, the flow of information is even more compounded and unpredictable.

The availability of electronic word processing was believed by upper and middle managers to be an assistance in decreasing the consumption of paper. Managers stated that they thought that electronic copies would be a great benefit, and that the printer would help reduce the usage of the photo copy machine. Unfortunately, photo copy usage has not decreased. This is due to the fact that the vast majority of items being photocopied are hardcopy instructions from higher authority or messages and correspondence originating from outside the command.

The situation of multiple document copies is a management problem. Managers at all three levels are using the microcomputer's ability to make easy changes and are producing an excessive number of working copies of everything that is being processed.

IV. THE INFORMATION TOOL

A. PLANNING, PROBLEM SOLVING, AND DECISION MAKING

Management and decision making are interrelated terms. There are many different aspects of the decision process that a manager must take into consideration for microcomputer information systems. Characteristics, such as the frequency of the decision, the scope of effect, and the management level at which it is made, all affect the nature of the information managers need to make quality judgements. Herbert Simon grouped decisions into two basic classifications. He determined that decisions were either programmed or non-programmed [Ref. 4].

The programmed decision is a structured judgement. As the frequency of a decision increases, managers tend to analyze the variables involved in determining a solution. The manager will develop procedures to deal with the situation so that the same results will be obtained at each occurrence of the problem. The non-programmed decision is one of non-structure. It is neither routine nor repetitive. The problem is usually unique and may occur only once, leaving the manager without a guide or set of precedents to follow. It is the difference of the managerial challenge between structured and non-structured decisions, which

separate the administrator from the manager. The manager
must survey the decision information, and make a cognitive
choice in the microcomputer environment.

The microcomputer is much more than an automated high
speed, low overhead secretary. Word processing, though
valuable, is a relatively minor capability of this complex
computer resource. Accompanying the Zenith-120
microcomputer was the relational database product dBASE II
and III.[1] A relational database is simply a series of
two-dimensional tables grouped by rows and columns. The
row, or tuple, is a set of attributes from a piece of
information. (Figure 4.1) The columns or attributes of the
information are keyed, listed, and cross-referenced for
quick access. The relational database creates a logical
domain of information in which the user can manipulate the
boundaries and relationships of the data involved.

An administration department head said, "what I need is
the ability to ask the computer for information on a
particular problem, and to get it now, so I can make quick
and intelligent decisions." That ad-hoc query capability
managers are asking for is already contained within the
resources they have. The problem is that no one is trained
with the knowledge to unlock the decision support potential

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[1]dBASE II and III are microcomputer-based relational
database software products. Marketed, created, and
trademarks of ASHTON-TATE.

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Snum     Sname     Major          Cname     Time     Room
.---------------------------.    .---------------------------.
| 0110 | SMITH | PHYSICS |       | PH4105 | MWF 8 | I-260 |
|---------------------------|    |---------------------------|
| 1000 | JONES | MATH    |       | MA2214 | TTH 9 | R-117 |
`---------------------------'    |---------------------------|
    STUDENT   Relation           | CS4500 | MW 10 | I-119 |
                                 |---------------------------|
                                 | OS3404 | MWF 9 | S-417 |
                                 `---------------------------'
                                        CLASS   Relation

              Snum        Cname
            .----------------------.
            | 0110   |  PH4105  |
            |----------------------|
            | 0110   |  MA2214  |
            |----------------------|
            | 0110   |  CS4500  |
            |----------------------|
            | 1000   |  OS3404  |
            |----------------------|
            | 1000   |  MA2214  |
            `----------------------'
            STUDENT_CLASS Relation
```

Figure 4.1   The Relational-Database Logical Structure

already available.   Less than 15% of the officers were even
aware of capabilities and limitations of the systems they
had in the squadron.   The software for the computer would
allow the manager to use conditional logic statements such
as: IF <condition> THEN, ELSE, DO, WHILE <condition> DO,
FOR, and many more powerful logical conditions applying to
data and assisting in problem solving.   The squadrons also
have a high-powered state-of-the-art spread sheet capability

to assist managers in projections and tracking unit training and planning.

The software packages on hand are high-level languages which enable the user to develop, design, and tailor application programs for individual needs of the units. They do require that the user analyze his problem, then design a program to implement a computer decision support system. There are no canned, structured computer programs, where the user interfaces with the machine to obtain information he needs to support his decision process. This lack of a "plug and chug" capability has been the major misconception of 90% of the managers and has hampered computer development projects in operational units.

B. ONGOING DEVELOPMENT

Some squadrons have shown more success than others in starting the ground work for program applications development.

One unit had the use of a Wang Personal Computer onboard the aircraft carrier from which they deployed. The Wang was tied into a microcomputer network. Each squadron, the Carrier Airwing Commander, and several major ship departments were able to share databases, and to communicate over the net. Electronic mail became an active part of network use. Squadrons were able to share messages, instructions, and reports. A daily airwing flight schedule

was compiled, produced, and disseminated electronically. Updates, changes, requests for data, and news reports from home were also passed through the network.

The Airwing Commander liked the system and directed each squadron to select a microcomputer officer, "preferably with personal experience and interest in serving on an airwing microcomputer users board". These officers were able to put together a simple sorting routine for listing personnel in the unit, and the selection to the list could handle up to two selection criteria. Selection criteria needed to be an attribute of the individual in the database such as rank, social security number, or birthdate. Unfortunately, no conditional commands such as greater than or less than were allowed. The requests were listed as: LIST FOR RANK = <value>. The drug and alcohol abuse officer in one unit was able to get the program to list individuals according to the last digit of their social security number when higher authority had directed random drug testing. Numbers were determined by a random number generator and he used the random number generated to produce the sorted lists for individuals to be tested. One unit, using the Zenith-120, had developed a man-machine interactive flight schedule generator (a computer prompted fill in the blank scenario).

Half of the units surveyed had not developed any uses for the microcomputer other than word processing. Reasons

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given were: no one was trained in software development, and no one was able to break away for the 1 to 5 day classes offered by the Navy Regional Data Automation Center (NRDAC). NRDAC has been tasked with the training program for operational units using microcomputer information systems. Units where the Commanding Officer stated he felt pressure to learn how to use a microcomputer, or where the Commanding Officer believed the maximum potential for microcomputers had already been obtained, had very little or no applications development ongoing within the command. Commands where senior officers had developed interest in microcomputers, were beginning to turn out programs and were using the microcomputer as a decision, problem solving, and planning tool.

C. THE MANAGEMENT'S ASSESSMENT

The Senior managers have evaluated the use of microcomputers in their command, naming security, mobility, and reliability as the three top concerns.[2] Security of data ranked first among Commanding Officers. The custody of electronically processed data as well as sensitive information, like officer fitness reports, has

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[2] Over half of the executive interviews were conducted during or after the Navy "WALKER" espionage case had broken in the news. This may have vaulted security over other areas of concern and may not have been a major concern prior to the Walker situation.

moved up the chain of command to either top or middle managers. Mobility, the ability to move equipment quickly, without equipment damage, to and from the aircraft carrier was the greatest concern of the Executive Officer. The Executive Officer is more involved with the day-to-day operations than the Commanding Officer. The complaint was that the Xerox 860 is a heavy, desksize piece of equipment. Transporting the computer has proven to become difficult over time. Systems have to be moved to the aircraft carrier and back to the home air base about twice a year. After three years, the original crates and boxes are no longer usable. Protecting the computer during shipment has fallen to the skills of in-house packing and protection. The Zenith-120 is small enough to fit into the standard steel cruise box containers and has not had this problem. No container large enough for shipping the 860 has been procured. With the life span of a computer around five years, the time it would take for procurement makes purchasing a container for the 860 a moot point. As the Navy makes future acquisitions of microcomputers, the ability to transport them should be included in the project development process.

Reliability, the third major concern of top managers, has its roots in the fear of computer systems. One commanding officer summed this feeling up saying "I'd like

to see it to continue to grow, as long as we have something that's very reliable. If you put information in there, and in fact, it's accessible, then I am happy."

Middle management listed utilization, quality of product, and security as their top three concerns. The administration department heads felt that there was a tendency to abuse the microcomputer. Their biggest complaint was that too many small and one-time jobs are being done on the word processor so that workers wait around for the word processor to be free while an electronic typewriter is sitting idle waiting for use. Middle managers feel that quality and professionalism of the final document product has indeed increased dramatically. In fact, once the senior managers saw the quality of the work that was attainable, nothing less was acceptable. This has been one of the major reasons behind the increase in time it takes to get a final draft of the document. The quality of the product received by the senior manager has become a standard of measurement in officer performance evaluations, and middle managers have responded accordingly.

Security of sensitive material was listed as the middle managers' third area of concern. Handling of sensitive material like award letters, personnel evaluations, and recommendations were mentioned as a management concern but custody, use, and processing of classified materials were never considered a problem.

The operational manager has shown the greatest approval or disapproval of the microcomputer information system. The operational managers named training and systems development education as their primary concerns and needs. Those who use a microcomputer feel it makes their work easier, more professional, and saves them time to address other problems. Some operational managers feel threatened; "I am behind the power curve because I don't know how to use it." They see their contemporaries using the microcomputer as a tool and edging themselves ahead of their peers.

The microcomputer's ability to meet manager's information needs were rated by the three management levels in four basic areas: accuracy, consistency, timeliness, and volume. Managers were instructed to include the man-machine interface as part of the microcomputer system as a whole. (Table IX)

Accuracy was defined as: the ability to produce a document without errors. Errors included spelling, grammar, and format. Consistency was defined as: The overall trend of document quality, the value of the product received, and a consistent professional product. Timeliness was defined as: The time it takes for a document to return to the manager and the processing time consumed in producing an acceptable product. Volume was defined as: The ability to handle the seasonal volume bottlenecks of paperwork, such as

change of commands, evaluations, and end of cruise reports. The rating scale was outstanding-5, excellent-4, good-3, fair-2, poor-1, and bad-0. The results reinforced the disgruntled comments made by the Division Officers.

TABLE IX

MANAGEMENT ASSESSMENT OF MICROCOMPUTER ATTRIBUTES

Management	Top	Middle	Operational

	Survey Response Averages		
Accuracy	3.8	3.5	2.8
Consistency	3.7	3.4	3.4
Timeliness	2.8	3.4	2.6
Volume	2.8	4.1	2.8

Numbers represent averages taken from 81 microcomputer assessment questionnaires. (Appendix B)

The operational manager gave the lowest overall marks. Closer examination revealed that the standard deviation of the responses were about twice that of the other two levels of management. Operational managers tended to gravitate toward the extremes, they either felt very good about microcomputer systems or were antagonistic. Those who had developed a user knowledge-base rated the system higher,

and those who feared or disliked the microcomputer rated its performance badly. Most middle managers were pleased with the microcomputer system and contrasted the other two levels of management on their evaluation of the systems ability to handle volume work. Middle managers rated the microcomputer excellent with respect to through-put, while operational managers closer to the working level, and senior managers, rated volume processing slightly less than good. Top managers were pleased with the accuracy and consistency of the product they were receiving. This was due to the fact that the document had been recycled 3 to 5 times before the senior manager was seeing the document. Overall, management liked the microcomputer resources they had, but felt there was a great deal of room for improvement and future development.

V. MICROCOMPUTER SYSTEM DEVELOPMENT

A. CURRENT POLICIES, STANDARDS AND GUIDELINES

Reasonable and well prepared standards and procedures will promote good processing practices, instill discipline and allow for variations and creative thinking from the management and work force. There are five basic goals and objectives for standards and procedures in information systems management: to control the processing activities, to control the processing quality, to control the processing time, cost, and resources, to improve the work force morale, and to be adaptable to changes [Ref. 5: pp. 171-189]. Some of these goals have shown to be counter productive in the aviation unit. In pursuing excellence in the quality of the information product, time and cost of information have increased. In pursuit of improving personnel morale by distributing microcomputer systems for maximizing availability and exposure, control of microcomputer information processing activities has declined. All of these trade-offs are decisions that senior management can make only when they recognize the interrelations between them. Then they will be able to make decisions that will regulate and manipulate the resources to obtain the desired level of performance.

Department Heads, from departments other than administration, have stated two main objections to establishing formal policies and standards which they could not control. The first is a fear of creating an atmosphere of inflexibility. The second objection is a concern over the ability to monitor, maintain, and enforce policies after they are in effect. Because of the decentralization of microcomputer resources, almost all policies and standards have been verbal understandings confined to the use of the individual machines within their respective departments.

The general policy of aviation unit Commanders, has been to have competent, well trained, and motivated division work force personnel to operate the microcomputer information systems. This policy is a verbal feeling of good will, and has not been written down. Senior managers were not able to identify in specific terms how they measure the success of this policy.

Two standards of specific performance expectations were identified during the study: time-share, and network security. Because of decentralization of resources, managers found at times one machine had considerable idle time, while another was operating at full capacity, with processing work backlogged. The Administration Officer was able to convince the Commanding Officer that an operating time share schedule should be implemented. A four hour time

block was assigned to each 860, time blocks were available for sign up one week in advance. No one was allowed to schedule more than two hours in any one day, or more than 8 hours in one week. The two 860 time blocks were separated to maintain full coverage of the 8 hour working day. The schedule was maintained by the operations department who did not own either machine. If machine time had not been reserved by the current day of operations, it became open time to all on a "first come-first served" basis.

The second standard was developed by a unit on the Wang PC network. Because the system was electronically open, the Commanding Officer had published a directive that no classified work above the grade of confidential would be allowed to be processed on the Wang PC. Written or verbal standards other than this had not been developed by the units. None of the units reported receiving policies, standards, guidelines or procedures from any higher authority on the operation and maintenance of their microcomputer systems.

Two squadrons had developed verbal procedures for handling classified material. In one unit, the officer needing classified information processed, submitted his own floppy diskett along with the rough material. The information was processed, then the rough material, all print outs, and the diskett were returned to the

originating officer. It was the officer's responsibility to maintain custody of the material. If the division worker was unable to finish the the work by the end of the working day, the material was locked in the administration department safe overnight. In a second unit, the administration department handled, processed, and maintained the classified information disketts. Original rough material along with all print outs were returned to the requesting officer. The disketts were labeled by classification level of the material on them, then stored in the administration department safe. In either case, neither a log nor a record was maintained of the classified material recorded, or who had custody of the same. In the case of individuals maintaining custody of their own material, no standards or procedures had been set for the safe keeping of electronic records. Some officers locked up material in a safe, others disclosed that they simply left disketts in a unlocked desk in a locked room.

B. DEVELOPMENT RESPONSIBILITY

Organizations have not moved rapidly into sophisticated information processing systems. Successful organizations have evolved into them. They moved through several different stages of learning about information processing and about their organization. Cyrus Gibson and Richard Nolan describe this computer information system movement as,

"the four stages of growth", in which management, "steer a course", toward successful and cost effective program applications [Ref. 6].

The four stages are initiation, expansion, control, and maturity (Figure 5.1). The start-up or initial stage occurs when the first computer acquisition is made. Gibson and Nolan stated that typically a computer is installed in the department where it is first applied. This definitely has been the case for the Navy aviation unit. In the civilian sector during the first stage, employees have had a fear of job displacement and eventual job loss. In the Navy it has been a reorganization of job responsibility and lines of informal communication. The start-up stage in Navy units was a very short period. The information processing mode change-over was neither smooth nor gradual. The average change-over period reported was 3 days. This was possible because the actual functions being changed-over during the initial stage remained the same. Only the way in which they were processed was new.

Within days of receiving their first 860, units had entered the growth stage. In the growth stage managers reported that their computers frequently had excess or unused capacity, or about three to four hours of idle time during the business day. Managers began tasking their new found processing capacity treating the microcomputer system
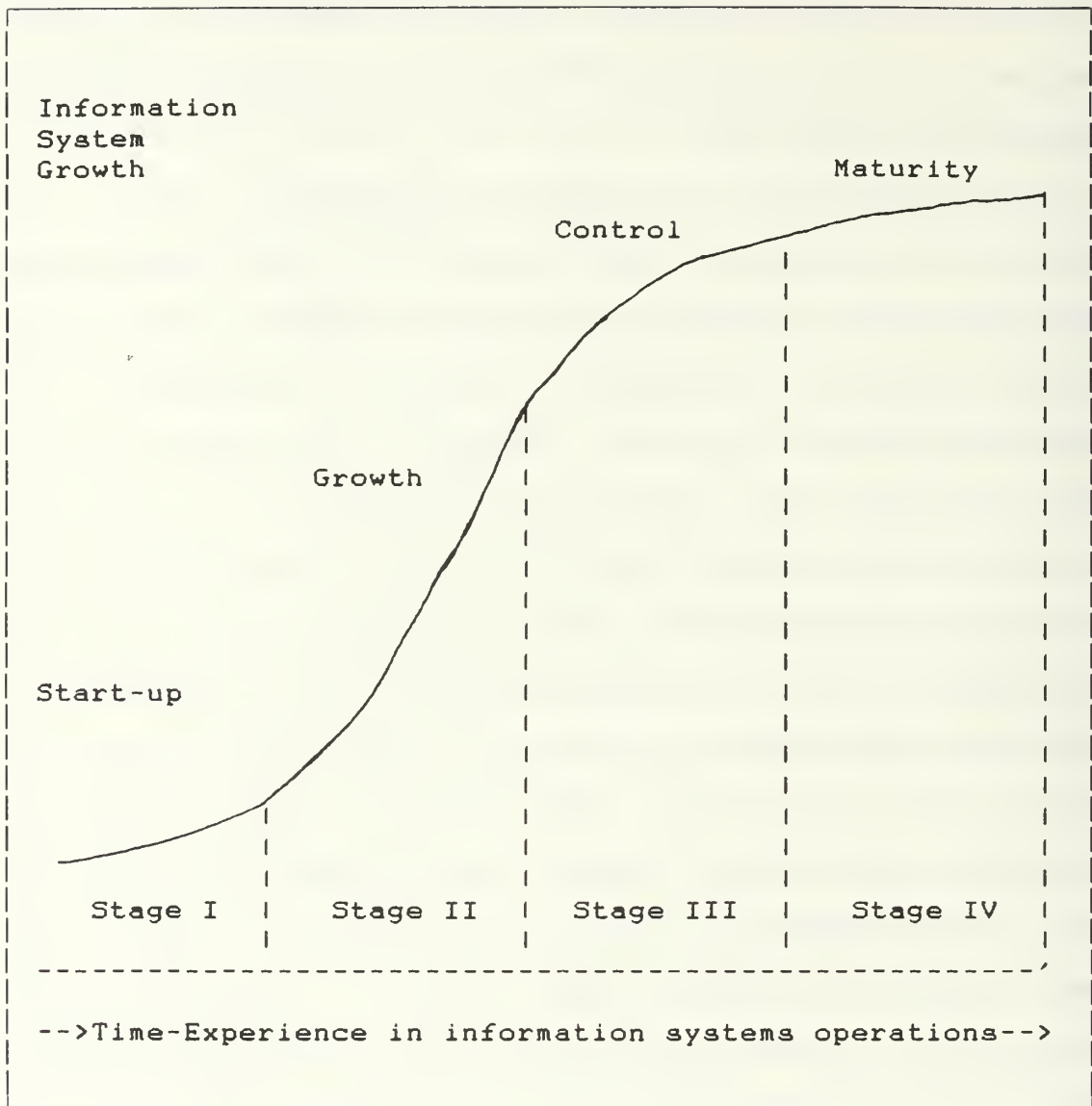
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| ----------------------------------------------------- |
| |                                                   | |
| |                                                   | |
| | Information                                       | |
| | System                                            | |
| | Growth                            Maturity        | |
| |                                        _____  | |
| |                               Control /       |   | |
| |                                 ____/       |     | |
| |                              __/          |       | |
| |                           __/           |   |     | |
| |                          /            |   |       | |
| |                 Growth  |           |   |   |     | |
| |                        |          |   |   |       | |
| |                       |         |   |   |   |     | |
| |                      |        |   |   |   |       | |
| |                     |       |   |   |   |   |     | |
| |                    |      |   |   |   |   |       | |
| |                   |     |   |   |   |   |   |     | |
| | Start-up         |    |   |   |   |   |   |       | |
| |                 |   |   |   |   |   |   |   |     | |
| |                |  |   |   |   |   |   |   |       | |
| |              _/ |   |   |   |   |   |   |   |     | |
| |          ___/  |   |   |   |   |   |   |   |       | |
| | _____/      |   |   |   |   |   |   |   |     | |
| |  Stage I  |  Stage II  |  Stage III  |  Stage IV | |
| |           |            |             |           | |
| | --------------------------------------------------/ |
| |                                                   | |
| | -->Time-Experience in information systems operations--> |
| |                                                   | |
| ----------------------------------------------------- |
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Figure 5.1   The Four Stages Of Information System Growth

as if it were a free commodity. Gibson and Nolan stated that during the growth stage capacity expansion begins, new acquisitions are made, and the control of the computer resources are usually decentralized [Ref. 7]. During this

stage the units seemed to lack clear guidelines for setting project and resource priorities for the equipment. Decentralization and lack of control did in fact occur. As costs, time, and conflicts increased, the middle managers tried to get control of the situation. This type of management action signaled the beginning of the control stage.

The Naval Aviation unit appears to be in the first three computer growth stages at the same time, depending on the system or processing function involved (Figure 5.2). With the Zenith-120, a "toy state" atmosphere abounds. Application programs are in their infancy, while more thought is given to learning what the capacity is, rather than to how it can be used. The units have moved into the growth stage in the use of reports for personnel manning and readiness training. The managing of in-house requirements are taking up the majority of unplanned growth and has kindled the management's desire to begin gaining control of the microcomputer processing systems. The word processing activities of the command are now well into the control stage of computer system growth. Management is beginning to bring standards and guidelines to bear on the control of this processing activity.

The Aviation unit information processing system is too dynamic to be categorized as in one stage or another. Too

many variables are tied to hardware, software, and people. The rapid growth of new technology and the shortening life cycle of computer obsolescence only heightens this problem. The standard movement through the information growth cycle associated with the computer systems of the 60's and 70's, is now in a continuous state of flux. Another problem unique to the aviation unit is a 100% manpower (management and work force) turnover every three years. The mythical stage of information maturity, where organizations maximize their effective use of computer resources, may not be an attainable goal.

C. RANGE, SCOPE, AND RESOLUTION OF CONFLICTS

For the manager, the term "artificial intelligence" invokes visions of a thinking and learning machine. Computer chess games, and medical diagnosis programs have been developed with the capability to support decision making, and can actually make decisions based on an extensive expert knowledge base. But making the decision is only the "tip of the iceberg". The ability to implement that decision and to make it work, is an intuitive skill yet to be programmed on to a silicon chip. The manager who has exposed himself to the ability and use of the microcomputer systems, understands their helpful uses as an aid and tool to assist the officer in managing the problem at hand. It is the continuum of the computer illiterate and unskilled
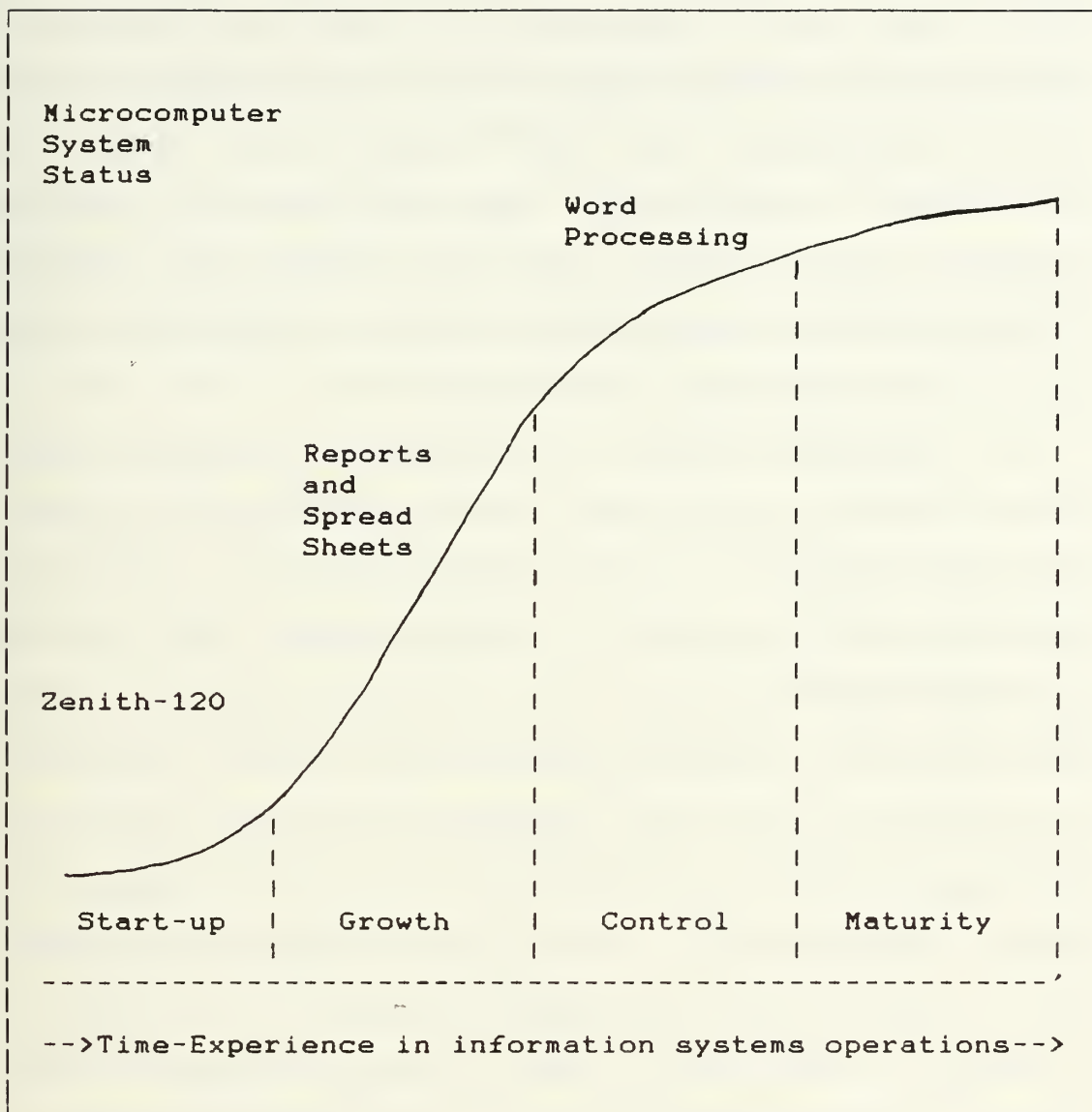
Figure 5.2   Computer System Growth Stage Development

officer who contributes to the fear and dislike of the computer system.

The actual problems encountered were not unique to microcomputer information systems. Control of resources,

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costs, time, and scheduling are old and basic management problems (in this case disguised with a green monitor face). Little difference in the range and scope of microcomputer conflicts were detected within the various aviation units. Only by the way in which the Commanding Officers resolved these problems, were differences detected on the daily operations of the units.

One Commanding Officer, who successfully gained an upper hand on resource allocation, had no knowledge on how to use a microcomputer. He made the issue of word processing performance and production a high priority item at his department head meetings. He continued applying command attention until Department Heads had developed and agreed to a workable procedure for cooperation and sharing of the microcomputer resources of the unit. He did not personally develop the guidelines, he skillfully recognized a problem, then orchestrated his "management resources" on a course to a solution. There were no right or wrong solutions to their problem, only a need to agree to a common procedure in eliminating the problem and avoiding a future management crisis. Flexibility, user-input and satisfaction, and management concurrence were obtained without the need of extensive research, analysis, or planning.

In another unit, the Commanding Officer felt frustrated with lower management's inability to deal with their

workload and resource allocation problems. He felt that microcomputers were a source of unrest and political bickering between the various Department Heads over the control of the machines. His solution was to amputate the problem, he gathered all three microcomputers, printers, disks, and software and placed them in one central location. He then gave the Executive Officer the responsibility to administrate the centralized computer resources. The centralization dramatically changed the way information was processed. Jobs now formed into a non-prioritized queue, awaiting the next available system. The processing environment was similar to a bank with several tellers and one line. Since the inter-department feuding had been resolved, workers and managers alike felt that the new system was working better than before, allowing a greater through-put of processing workload. But resentment, and a feeling of a loss in confidence in junior officers by the Commanding Officer was expressed by more than one manager.

One overriding issue has led to microcomputer conflicts or mismanagement in aviation units. The issue was the lack of guidance or leadership from senior managers. This void of guidance resulted from a lack of action and dissatisfaction from the senior manager. Senior managers need to take an active part in initiating policy issues of microcomputer information systems.

D. THE PERSONAL COMPUTER

The vast majority of all aviation officers have been out
of college longer than most microcomputers have been on the
market. In spite of this fact, 15% of the division officers
and 20% of the department heads surveyed owned a personal
computer. One Commanding Officer owned a microcomputer, but
purchased it for his son in high school and never learned to
use it.

At least one personally owned microcomputer (PC) was
being used as a management tool by officers in every unit
interviewed.   The PC was used as a word processor and as a
database manager.   The only negative comments came from
peers of the officers who were using them.   Division
Officers working with operators of PC's felt increased
pressure to learn to use a microcomputer in order to turn
out workload of the same quality as those who were either
using a PC or squadron microcomputer system.

The major benefit units received from PC usage was a
decrease in the strain on administration departments
information processing.   The PC reestablished lines of
communication between operational and middle managers. When
a senior or middle manager returned a document for update,
or had a question on a particular report,   the senior
managers would discuss this with the originating Division
Officer rather than the administration division worker.

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Additionally, officers who owned and operated their PC's were a valuable source of knowledge and training to the unit for other officers wishing to learn how to use a microcomputer system.

VI. COMPUTER LITERACY

A. CURRENT COMPUTER LITERACY

The Naval Aviation Officer is more than a sophisticated aviator with a mastery of a warfare specialty skill. The aviator must manage his environment using sound judgement, imagination, forcefulness, personal behavior beyond reproach, and maintain a good feeling of military bearing with his superiors and subordinates. He is evaluated on his ability to set goals, and achieve them. He must maintain high working relations, and have the ability to take effective actions in stressful and prolonged situations. But the ability to speak, and write in an effective manner has been a major factor to a successful naval career. Oral and written analytical expression has been the foundation of the development of the manager of the past. These skills are not less important today, but are now incomplete in the ability to support the future Navy manager's information needs and requirements.

With the introduction of microcomputer information systems, the decision making styles of the manager are beginning to adapt to the influx of computer technology. The manager is now capable of processing more data to obtain more accurate information over a shorter period of time.

At the present time, 16% of the officers use a microcomputer information system. But 90% of the squadron's information needs are being processed electronically. Many officers are managing their jobs and resources with the use and aid of these systems without the knowledge and understanding of their capabilities. Most Navy managers have recognized the need to develop computer literacy, if not to use a system, to direct and manage the application of these systems. Current computer literacy is low, but in 5 years a new generation of computer smart operational managers will be in place in the aviation unit. It is the future middle and senior manager's needs, requirements, and computer knowledge that should be targeted for action in the field today.

B. PAST AND PRESENT TRAINING PATTERNS

Aviation units have been sending their division work force personnel to formal education and training classes for operation of their microcomputer systems. These schools are from 1 to 2 weeks in length. Division work force personnel were taught basic machine operating skills: system operation was geared to machine familiarization. Elementary word processing functions were addressed, and a follow-up intermediate operation course was offered. Only one division worker was found to have gone to the second week of the intermediate training course.

With the arrival of the Zenith-120, NRDAC has been offering training classes in beginning and intermediate programming for dBASE II and III. Courses in using spread sheets and advanced word processing on the microcomputer are also available. Several operational managers attended the dBase courses. The operational managers attending the courses had previous personal experience from their own PC's. Operational managers who attended said, "the course spent the majority of time in elementary operations", "they used a simple premade programmed text", and "only one day was spent on program development." The units would have been better off sending officers with no skills or computer experience. The audience the training is for are the new and first time microcomputer users. The software training has been sporadic, but it has exposed system capabilities to managers who can use the microcomputer in his job. The primary source of microcomputer knowledge to the unit remains the self taught computer hobbyist.

C. TRAINING PERCEPTIONS

Senior and middle managers felt that too much training is required for junior officers to gain the skills needed to implement information systems applications. Available time will not allow the operational and middle managers to be freed from their regular duties to go to the training courses offered. Additionally, one Commanding Officer said,

"I don't believe the time invested by Division Officers justifies the return from any operating program." When operational managers attempt to develop software applications without the skills of software engineering or the ability to analyze information requirements, a lot of time can be wasted on a poor quality product. Operational managers can become frustrated in trying to solve a computer program without the right tools for the job. The results are an ad-hoc program development, with low user acceptance, use and satisfaction.

Information technology is here to stay. The Naval Academy is developing a computer system where each midshipman will have a computer workstation available. Education and hands on experience with local area networks, such as the Wang PC network, and access to the Defense Data Network (a wide area network) will enhance the junior officer's ability to utilize computer systems. The Naval Academy has stated that their goal is to "Implement information technology and computing applications into curriculum wherever appropriate" by 1986. It will take about 5 years for the flow of computer literate midshipmen to reach the ranks of the operational manager. [Ref. 8]

VII. CONCLUSIONS AND RECOMMENDATION

A. NEEDED SKILLS AND USER TRAINING DEVELOPMENT

The motivation for a training program is based upon the changes in the importance of microcomputer information systems and the development of information applications. With the goal to improve microcomputer processing productivity, there is a need to increase microcomputer information systems management skills. Training development should address the increasing complexity of future demands in three basic areas, people needs, skill needs, and tool needs. The training program should stress the integration of management skills with data management and data communications. Not everyone needs to be an information systems designer or implementer, but every manager must be able to interact with and manage information system operations.

To manage the microcomputer information systems, the manager will need to gain knowledge in information systems technology, information systems concepts and processes, and the application of microcomputer information systems to organizational functions. By combining organizational functions and management knowledge with technical information systems knowledge, the Navy manager will be

effectively interacting with organizational functions and microcomputer technology. Every manager should be able to effectively operate a microcomputer using a pre-developed operational program. Every manager should be familiar with basic machine operation and understand the limits and capabilities of the microcomputer resources under his control. Every manager should be able to use word processing, and spread sheet capabilities of the microcomputer. As managers learn these skills, they will spend more time planning, and a lot less time reacting to the information challenges of the future.

B. MANAGEMENT AWARENESS

It is impractical at this time to train every officer in microcomputer systems development, analysis and design. However, there is a need for the aviation units to provide these skills for management's use in information applications development. The responsibility for microcomputer information systems should be divided into two areas: Management Information Systems and Data Administration.

Management Information Systems should be part of the Operations Department and fall under the scope of the Training Officer. Duties and responsibilities of the Management Information Systems Officer should include but not be limited to:

1. Information systems application requirements analysis.

2. Information application feasibility studies.

3. Process and product benefits analysis.

4. Exsisting systems impact review.

5. Logical and physical program design.

6. Certification and testing of command development applications.

7. Implementation and control design.

8. Training and consultation to other managers within the command.

Just as every officer cannot specialize in legal affairs, computer systems development now requires a specialized training officer within the command, to be a management resource to the Commanding Officer.

The second area of unit reorganization is the need for a Data Administrator. The Data Administrator should be part of the Administration Department. He should be responsible for the protection and regulation of the squadron database, maximizing benefits to all users within the command. Microcomputer information system standards, guidelines, policies, and procedures should be developed by the Data Administrator for the Commanding Officer. He should review all practices of information system operations. The Data Administrator should work with the Management Information

Systems Officer to standardize data activity and database structure. The Data Administrator would not manage data, but data activity. By providing and regulating standards and procedures, he would ensure that system users do not interfere with one another when managing the data. Database processing must be standardized. Every data field, name, and format must mean the same thing to a manager in maintenance as well as in operations. The Data Administrator must work with the Management Information Systems Officer in providing reliable documentation on data structures and program applications for other managers to use in information operations. Another concern of the Data Administrator is data ownership, or who has access and modification rights to stored information. The Data Administrator must keep abreast of privacy act requirements and classified material regulations.

Another need is to have a central control clearing house of shared ideas and program application developments. There is a need for a Computer Information Systems Coordinator at the Pacific and Atlantic Wing level. The Computer Information Systems Coordinator should be a point of coordination and dissemination of management applications. Training and project assistance is another important service the Coordinator should provide.

Harry S. Truman once said, "We cannot do everything at once, but we can do something at once." To obtain a level of excellence in microcomputer system operations by the end of the decade, action and progress must begin now and be continuous.

APPENDIX A

ORGANIZATION RESEARCH INTERVIEW QUESTIONS.

The major portion of research material was gathered through
in depth interviews of the three management levels in the
aviation organization structure.   These questions served as
a general guideline, and interviews were adapted on a case
by case basis.

The Top Management Interview
(CO/XO)

1. What is your organization's mission?

2. What are your mission's objectives?

3. What are your job responsibilities?

4. What measurements do you apply to your objectives?

5. What information do you need to meet your objectives and
    responsibilities?

6. What kind of microcomputer systems do you have in your
    organization?

7. Do you personally use a microcomputer?

8. Within your organization, are microcomputers used in solving information problems, decision support, or planning?

9. What type of microcomputer supported reports do you use?

10. What type of incoming/outgoing data is processed by microcomputers?

11. Do you feel pressure to use a microcomputer in your work?

12. Have you ever had formal training on a microcomputer information system or a word processor?

13. Have you developed any personal experience on a microcomputer?

14. Do you perceive any need for additional training on microcomputer systems for yourself?

15. What training and education for microcomputer use and development do you feel is needed for officers under your command?

16. What policies do you have for microcomputer use within your command?

17. Who promulgates, reviews and submits these policies for your approval?

18. What is you assessment of microcomputers?

19. What is the most useful microcomputer information you receive?

20. What are your three top microcomputer concerns?

21. Are there any privately owned microcomputers used for work within your command?

22. Do you know what they are used for?

23. Have you ever conducted a survey on private or government microcomputer use within your organization?

24. Have you had any problems with microcomputer systems and the personnel who use them for their work?

25. How have you resolved these problems?

The Middle Manager Interview
(Department Head)

1. What is the mission of your department?

2. What are your job responsibilities?

3. What measurements do you use to gauge the effectiveness of your objectives?

4. What information do you need to meet your objectives and responsibilities?

5. What type of microcomputer systems do you have or use in your department?

6. Do you use in your department microcomputers to solve information problems, support your decision process, or to implement planning?

7. What type of data base is incoming/outgoing to your department and is processed by a microcomputer?

8. Do you feel pressure to use a microcomputer in your work?

9. Have you had formal training on a microcomputer system or word processor?

10. Have you developed personal experience or interest in microcomputers?

11. Do you perceive the need for additional training on a microcomputer for yourself?

12. What training and education for microcomputers do you feel is needed for officers in your department?

13. Have you received any policies or guidelines from your superiors on the use of microcomputers within your department?

14. Have you developed any standards or procedures for using microcomputers?

15. Are there any personally owned microcomputers used within your department for military duties and responsibilities?

16. Do you know what they are used for?

17. Is there any classified or sensitive data, such as officer fitness reports, being processed electronically?

18. How do you store and safeguard microcomputer data of this nature?

19. Have you had any problems with microcomputers or the personnel who use them in their work?

20. How do you resolve these problems?

21. How do you determine microcomputer scheduling?

22. What is your assessment of microcomputer performance?

23. What are your three top microcomputer concerns?

24. What is the most useful microcomputer information you receive?

25. What changes do you foresee in the future for microcomputers in your department?

26. What type of microcomputer training do you have in your department?

The Operational Manager Interview
(Division Officer)

1. What is the purpose of your division?

2. How do you see the mission of your unit, and how does your division support this mission?

3. What are your division's objectives?

4. What are your job responsibilities?

5. How do you measure the accomplishment of your objectives?

6. What information do you need to fulfill your job responsibilities?

7. What type of microcomputer systems does your division use?

8. Do you personally use a microcomputer?

9. Do you or your division use microcomputers to solve information problems, support the decision process, or implement planning?

10. What type of microcomputer supported reports do you use?

11. What type of data is incoming/outgoing to your division and is processed by a microcomputer?

12. Do you feel pressure to use a microcomputer in your daily work?

13. Have you ever had any formal training on a microcomputer?

14. Have you developed personal experience or interest in microcomputers?

15. Do you perceive the need for additional training on a microcomputer for yourself?

16. What training would you like to see on microcomputers for new Division Officers before they arrive at the unit?

17. Have you received any standards or procedures from your superiors on the use of microcomputers within your division?

18. Have you developed any standards or guidelines for using microcomputers?

19. Are there any personally owned microcomputers used within your division for military duties and responsibilities?

20. Do you know what they are being used for?

21. Is there any classified data or sensitive data, such as enlisted evaluations, being processed by a microcomputer?

22. How do you store and safeguard microcomputer data of this nature?

23. Have you had any problems with microcomputers or the personnel who use them?

24. How do you determine priority scheduling for microcomputer use?

25. How do you resolve these problems?

26. What is your assessment of microcomputer processing?

27. What are your three top microcomputer concerns?

28. What is the most useful microcomputer information you receive?

29. Are there any on going microcomputer projects in the
    planning, development, on implementation stage?

30. What type of microcomputer training do you have in
    your division?

31. What changes do you foresee in the future for
    microcomputers in your division?

MICROCOMPUTER ASSESSMENT QUESTIONNAIRE

The following questions are meant to determine how Navy managers assess microcomputer information system performance in meeting information production needs. The words "microcomputer system's" refers to software, hardware and personnel. Please answer the questions by filling in the answer of your choice.

OUTSTANDING-5, EXCELLENT-4, GOOD-3, FAIR-2, POOR-1, BAD-0.

How do you rate your microcomputer system's ability to produce an accurate document, free from spelling grammar and format errors_____.

How do you rate your microcomputer system's ability to provide a consistent high quality document. Is the document of value_____.

How do you rate your microcomputer system's ability to provide you with an information product on time_____.

How do you rate your microcomputer system's ability to handle a high volume of information processing_____.

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